

CLAIMS

1. A method for the cutting of thick sections of cement-based materials, the method comprising the steps of: mutually traversing a surface to be cut with a laser beam at a power density such as to produce a depth of molten material of a maximum of
5 10mm at each traverse; allowing said molten material to solidify; breaking said solidified material into particles; and, removing said particles by suction means.
2. A method according to claim 1 and comprising a plurality of traverses along substantially the same cutting path.
3. A method according to either claim 1 or claim 2 wherein the laser beam is
10 unfocused.
4. A method according to claim 3 wherein the laser beam is a parallel beam.
5. A method according to claim 4 wherein the laser beam has a rectangular cross section.
6. A method according to any one preceding claim wherein the re-solidified molten
15 material is removed directly after solidification after each pass.
7. A method according to any one preceding claim wherein the re-solidified material is broken up by a hollow crushing tube which also serves as a material extractor conduit.
8. A method according to any one preceding claim wherein the depth of the molten
20 material at each pass lies in the range from 0.5 to 5mm.
9. A method according to claim 8 wherein the depth of molten material lies in the range from 1 to 4mm.
10. A method according to claim 9 wherein the depth of molten material lies in the
range from 1 to 2mm.
- 25 11. A method according to any one preceding claim wherein the pressure required for crushing the re-solidified material is less than 100MPa.
12. A method according to any one preceding claim wherein the laser power density lies in the range 300W.cm^{-2} to 12000W.cm^{-2} .
13. A method according to any one preceding claim wherein the beam traverse speed
30 lies between 3cm.min^{-1} and 40cm.min^{-1} .

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14. A method according to any one preceding claim wherein an oxygen jet is applied directly at the beam spot when reinforcing steel bars are being cut.
15. A method according to any one preceding claim wherein the surface temperature of the material being treated lies in the range 700°C to 2400°C.
- 5 16. A method wherein the vapour-to-melt ratio lies in the range between 0.05 and 3.
17. A method according to any one preceding claim wherein the material removal rate lies in the region of $150 \text{ cm}^3 \cdot \text{kWh}^{-1}$ for a diode laser and $100 \text{ cm}^3 \cdot \text{kWh}^{-1}$ for a CO₂ laser.
18. A method according to any one preceding claim wherein the laser is selected from a CO₂ or diode laser.
- 10 19. A method according to any one preceding claim from 1 to 17 wherein the laser is selected from one of: Nd:YAG, diode, or COIL type lasers.
20. A method according to claim 19 wherein the laser beam is delivered by a fibre optic cable.
- 15 21. A method according to any one preceding claim wherein the laser beam is delivered by a mobile beam delivery system comprising a system of reflecting mirrors.
22. Apparatus for the cutting of thick sections of cement-based materials by the method claimed in any preceding claim, said apparatus comprising means for mutually traversing a surface to be cut with an unfocused laser beam at a power density sufficient to produce a depth of molten material of a maximum of 10mm at each traverse; means for breaking melted and re-solidified material into particles; and, means for removing said particles by suction means.
- 20 23. Apparatus according to claim 22 wherein the means for breaking re-solidified material comprises a percussive member for crushing the material.
24. Apparatus according to claim 23 wherein the percussive member is hollow and crushed material is removed through the member by suction means.
- 25 25. Apparatus according to any one of preceding claims 22 to 24 wherein the laser beam is substantially parallel.
- 30 26. Apparatus according to any one of preceding claims 22 to 25 wherein the laser beam has a circular cross section.

27. Apparatus according to any one of preceding claims 22 to 25 wherein the laser beam is rectangular in cross section.